RFP 16-01
EXHIBIT L

Infrastructure solution Options for

Corporations and Charities System

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Contents

Introduction

Corporations and Charities division is in the process of developing a new custom solution. The solution also requires hardware and software architecture to be upgraded along with opportunities to leverage cloud or hybrid computing infrastructure options.

The document provides a proposed deployment infrastructure model along with options analysis for both cloud and on premise options for infrastructure.

This guidance set addresses only the hardware and software needs, design, and implementation of a infrastructure that includes core networking, storage, and compute capabilities for Corporations and Charities Division System. This document does not provide any recommendation or evaluation of the overall OSOS infrastructure or other services in terms of CTS vs. Self-Hosted models.

The Document is divided into following sections

1. **Conceptual Infrastructure Design:** Describes a model organization and a proposed infrastructure model to implement the CCS solution.
2. **Design Options:** Details all of the planning considerations for hardware and software that comprise the overall infrastructure. This includes the network, storage, and compute components of the infrastructure. Further, it addresses planning considerations for different types of availability, scalability, performance, and security needs.
3. **Design Decisions:** Details *what* design decisions, as defined in the Scenario Definition, were made from the considerations covered in the Design Options Guide, as well as the rationale for *why* they made the decisions.

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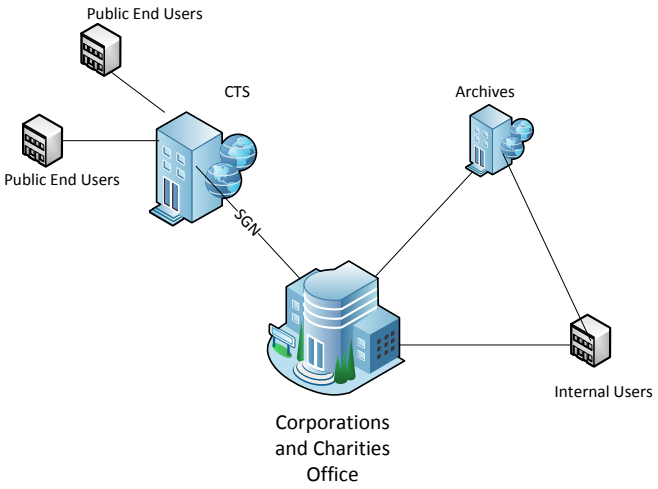
Conceptual Infrastructure Design

The organization Corporations and Charities is organized as following locations



Corporations and Charities key facts

- 100,000+ users of the public website.
- 30+ internal users with document / imaging needs in various business units
- 8-10 Order Receipt, Front counter and walk in customer service staff that process checks or other documents needing validation
- 2 High speed scanners

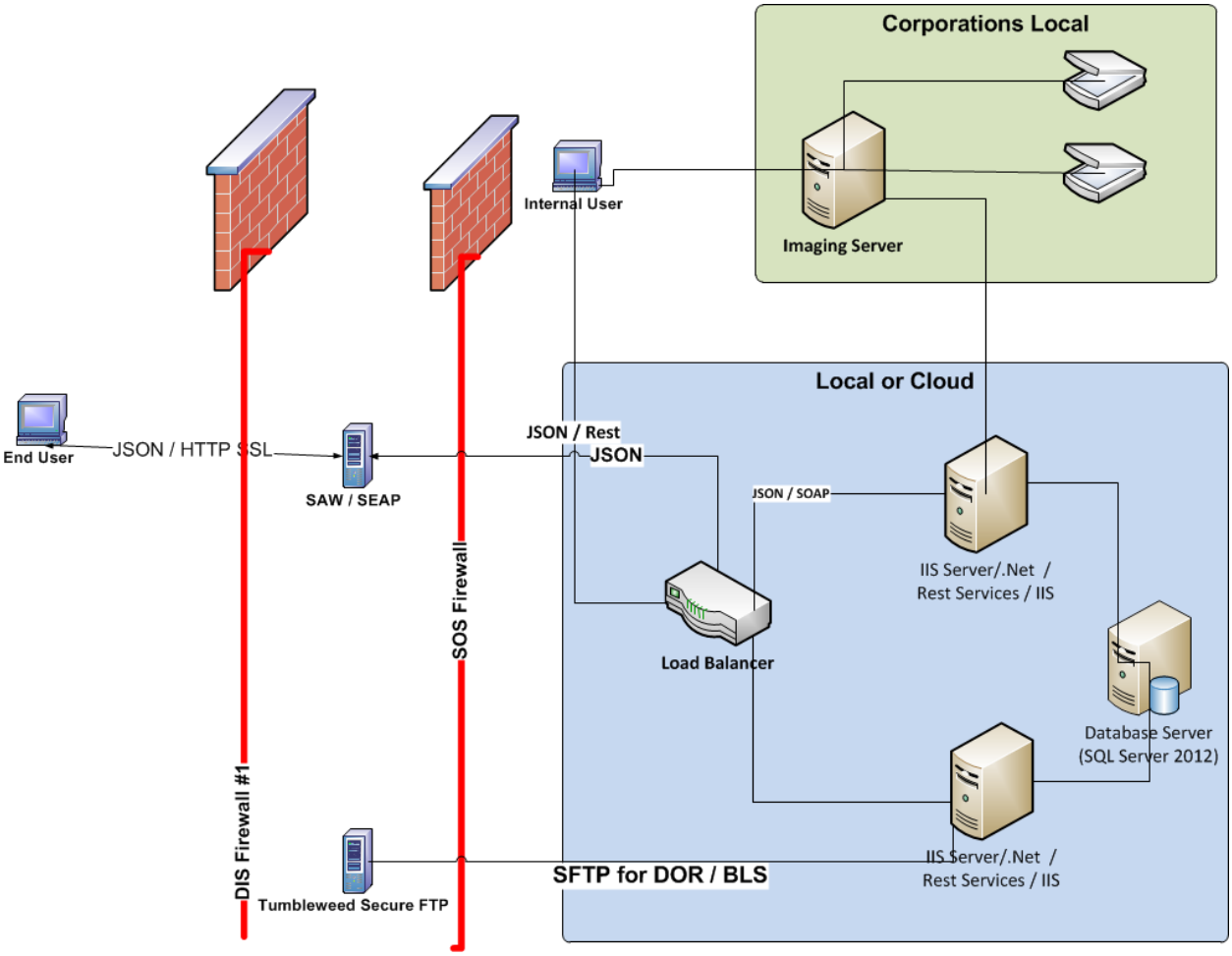
Corporations and Charities problem statements / Constraints

- Aging Servers
- Significant Volume of Document Imaging
- POS devices and printers

Corporations and Charities situation statements

- Currently trying to increase online usage and improve maturity on internal processes.
- Developing a new Corporations and Charities System.
- Evaluating possible cloud based deployment of the new system for better cost / ROI and predictability

Conceptual Physical Architecture



The Physical / Server architecture for CCS is inherently kept very simple and scalable by incorporating known Microsoft technologies and a Web based architecture.

The infrastructure requires the scanning and indexing components that need to be local to the building due the high speed scanners and document scanning needs of internal users.

The application and server components of the infrastructure can be hosted in the cloud or locally based on the cost and overall considerations noted in the design options.

The basic on infrastructure is composed of

1. **A well scaled database server**: This is the core repository for the SOS information and the database server should be scaled up for both physical memory as well as the storage.
    a. **CPU**: Dual CPU Quad core (2 to 4 Socket Servers)
    b. **RAM / Physical Memory**: 64 to 128 Gb RAM

c. **Storage**: Rough Estimates of 2 Terabytes of Storage. (High Estimate)

d. **Software Licensing**: Windows Server OS, SQL Servers (Web Usage License)

2. **Application IIS Servers**: These are application Servers that will host the web services, batch processes and the website for the SOS internal and external users. We estimate these servers to more CPU intensive than storage intensive.

    a. **CPU**: 2 Quad core CPU

    b. **RAM / Physical Memory**: 32 to 64 gig ram

    c. **Storage**: 128-256 GB of storage.

    d. **Software Licensing**: Windows Server OS, IIS Web License

3. **Scanning Indexing**: The scan index servers need a minimal hardware and over the planned application lifecycle the scanning volume is anticipated to go down so we expect that the servers don't need to be scaled up significantly.

    a. **CPU**: 2 Quad core CPU

    b. **RAM / Physical Memory**: 32 gig ram

    c. **Storage**: 256-500 GB of storage.

    d. **Software Licensing**: Windows Server OS, Kofax License.

4. **Other Networking Components**: Various other networking components, load balancers and network connectivity and network traffic, security /firewall servers etc. are needed to enable the overall application infrastructure work. These networking components may leverage different technologies / approaches that depend on cloud vs on premise hosting options.

    a. **Firewall**: The current infrastructure allows a state firewall at CTS and another firewall at SOS infrastructure level.

    b. **Load Balancer**: The load balancer component is to ensure that there is a redundant server load balanced for high availability and scalability.

    c. **Network**: The network aspect of the infrastructure has different considerations based on the different design options as highlighted in the sections below.

Design Options

The design options for CCS include

1. On Premise Hosting
2. Hybrid Hosting (Scan Index Servers Hosted on premise and Application and Database Servers Hosted in the cloud)

The following sections describe the basics of decisions in each of the areas of infrastructure including network, server and other design options.

1. **Network Connectivity:** Corporations building has a lower bandwidth connectivity coming down to the building. The bandwidth is key to ensuring that SOS staff has a system that performs well especially with dealings with documents / images. If the database and application servers are hosted on premise the internal network can easily handle the performance needs. Any cloud hosting option would require upgrading the network bandwidth in and out of building and monthly cost should include such option.
2. **Server Hosting Location / Cost**: Depending on location of the servers there may be hosting / electricity, power, redundancy and disaster recovery costs that need to be considered in the overall cost of the service comparison. The cloud hosting options include all the costs in a single package whereas the cost of on premise hosting may have these costs mixed in with the overall costs of space / lease. Disaster recovery services and the type and nature of these services may have other considerations of cost both in terms of server hardware, colocation and network costs.
3. **Network Traffic Usage Costs:** The network traffic is another item to consider in overall cost / options planning. While the current network may cost a fixed monthly fee, a move to cloud will add a variable cost of network traffic. In the cloud hosted model, not only will OSOS pay network cost of public accessing the Corporations data it will also be paying a variable network usage cost on network bandwidth for access of data by internal SOS employees.
4. **Application Servers:** The cost of application servers is something that can vary in the cloud environment based on the Compute usage. In the internal servers this cost will be fixed based on server scale established in the capacity planning. The application server capacity scaling is an important aspect of the cloud movement where organizations can scale based on seasonal capacity requirements e.g. quarterly reporting, elections traffic etc. In capacity demands that are fairly well spread through the year the cloud infrastructure typically tends to cost more than on premise.
5. **Data / Database Servers:** The data / database servers are servers on which image files and the data will be stored. This is one of the most important aspects of the infrastructure and storage for backup and restore and other operations is a key consideration. A common misconception in cloud hosting environments is that the data

is automatically backed up and restore and recovery is seamless. Our experience is that this storage and recovery needs planning and even more conscious planning since there is less control on the location of the data. The main cost here will be the long term storage needs based on the archiving and record retention requirements.

6. **Security / User Management:** In a cloud environment with this being one of the first secure applications some investments may be required as it relates to security and user management to allow internal users to log into the remote application and integrate with the active directory. There are not many statewide applications that have moved systems of the nature of CCS to the cloud.

Cost Estimates

Component	Cost on Premise	Cost Cloud	Comments
Network Bandwidth Increase			Only for Cloud
Data Transfer Costs			Only for Cloud
Application Servers (Compute + Storage)			On Premise Costs can be amortized over a 3 year Lease.
Application Servers (Software)			
Data Servers (Compute + Storage)			
Data Servers Software Licensing			
Security Components			One-time costs amortized over 5 years, any variable costs
Servers Hosting / Power Costs			Approximated Power costs Only for on Premise. Space and cooling costs are negligible
Test Environment Costs			Depending on the testing environment configuration. If an identical environment is used. The cloud servers may have costs for software licensing vs. on premise licensing included in the MSDN / Microsoft Licensing costs.
Other Cloud Costs			
Other On Premise Costs			
Disaster Recovery / Redundancy Costs			Will Vary in both environments based on the level of Disaster Recovery and Redundancy
Other Software Licensing Costs			These costs will be further defined as other aspects of the solution get defined. E.g. PDF editing, Letter Generation.
Total			

Design Decisions

Summary

In summary the architecture of the CCS system lends itself well to different type of options and other configurations for infrastructure hosting can be explored as a separate effort to review SOS as an enterprise.

In the context of CCS the cloud is not a right away a simple decision unlike applications that have a high ROI due to a seasonal traffic and compute scaling requirements. The ROI of the cloud must be carefully considered along with the user and application performance considerations as a whole.

One significant consideration in the context of cloud planning is the cost of disaster recovery planning and redundancy. These options would require a careful consideration towards business continuity planning and other requirements that may have some influence on the preferred approach.

A general concern in on premise hosting is the initial upfront investment and ongoing upgrade costs and ability to have a somewhat predictable cost model or a usage based cost model in the cloud. These concerns can be mitigated by aligning and planning the upgrade cycles of infrastructure and licensing and either plan for leasing servers and software or proactively amortizing the cost upfront and allocating monthly costs into an infrastructure upgrade account to prevent aging infrastructure and due to delayed upgrades.

Recommendation

Recommendation to be made based on cost comparisons.